

El Portal Fire – Sediment/Debris Runoff Mitigation

Scoping Trip Report

September 25, 2014

Prepared By:

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Executive Summary

Upon review of the Hydrology Resource Report, Geologic Hazard Assessment Report, Existing Topographic Exhibits, field visit, and discussion with NPS Staff we are recommending a number of alternatives to mitigate Debris and Sediment runoff for the project site. Two existing structures were visited; 5674 Foresta Road and 9722 Buckeye Road. Both structures are located in the direct path of existing ephemeral drainage swales. The recent El Portal Fire burned large portions of both watersheds that provide runoff to the drainage swales. Post-fire conditions will increase the runoff from the watersheds and provide a risk of debris and sediment runoff. There are mitigations measures that could be applied to both swales to increase protection for the two structures. Construction access is restricted to both areas and will reduce the number of potential solutions for mitigation. Debris and sedimentation mitigation measures for these two swales could include the maintenance of the existing gabion weir, installation of pre-cast concrete blocks, construction of additional gabion check weirs, and rockfall barrier fences.

Site Background

The site being reviewed lies with the El Portal USGS 7.5 minute Quadrangle map and is generally located at Latitude 37°40.6' North and Longitude 119°46.8' West. The two structures are located along the northern edge of the community of El Portal. Elevations of the structures are between 2080' and 2120' above sea level. There are approximately 80 building structures located in the surrounding community, most located at lower elevations and situated between the hillside on the North and California State Highway 140 on the South.

Existing Conditions

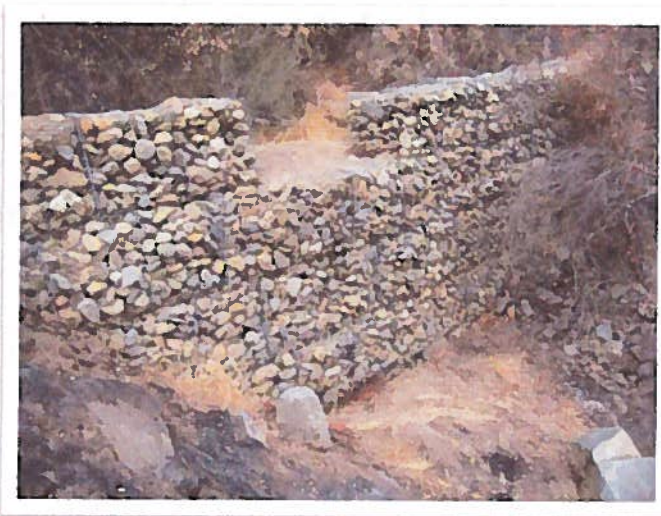
At the time of the site visit, the native terrain consisted of oak trees, pine trees, manzanita brush and native grasses including poison oak. Most areas immediately surrounding the structures were landscaped and maintained. The southern limit of the El Portal fire was located in the El Portal community. Post-fire conditions included charred oak leaves, ashen groundcover, and burned brush and trees to varying degrees. The notable conditions observed within the fire limits were the absence of ground cover and exposed soil.



Terrain

Both structures visited are located at the foot of a hillside immediately north of the El Portal community. The drainage swale extends upstream of the Buckeye Road structure and gains approximately 440' of elevation with the first 1000'. The swale located near the Foresta Road structure gains 280' of elevation within the first 1000' of the swale. The local terrain is described in the Geologic Hazard Assessment document as steep terrain with igneous intrusive and metamorphic rocks.

Current Sediment/Debris Mitigation Deficiencies



Our site visit included a cursory inspection of the existing gabion weir located approximately 480' west northwest of the Foresta structure. The existing weir is located within the drainage channel. It consists of stacked gabion wire baskets filled with rounded stones with approximate diameters ranging from 2-inches to 8-inches. The weir appeared to have 5 lifts with each lift being about 3-feet tall. The thickness of the structure is approximately 6-feet wide, and the top lift is only 3-feet wide and situated flush

with the downstream edge. The weir spillway was measured to be 10-feet above the flow-line of the drainage channel on the downstream side. The top of the gabion structure was measured to be 13-feet above the channel bottom on the downstream side. On the upstream side, the weir overflow was measured to be 4-feet above the drainage channel. It appears that over time, approximately 6-feet of sediment has been accumulated on the upstream side of the gabion structure.

Based on rough volume calculations, the existing gabion weir could retain approximately 70 cubic yards of material if it remains at the 4-foot depth. If the existing sediment is removed and the upstream height of the weir approaches 10-feet, our volume calculations yield a volume of 170 cubic yards. These calculations are based on the existing width of the gabion structure at 42-feet and a longitudinal retention of 60-feet upstream.

Document Review

Hydrology Resource Report

Our staff reviewed the provided BAER Assessment document to familiarize ourselves with the site and storm runoff calculations. The report corroborated our observation of the existing gabion dam as to the depth of sediment on the upstream side. The watersheds contributing to the storm runoff for both structures are established in the report. The watershed area contributing to the Buckeye Road structure was reported to be 18-acres, while the Foresta Road structure area was listed as 33-acres.

The report anticipates increase stream peak runoff flows due to the post-fire conditions due to the reduction of ground cover and infiltration as well as decreased infiltration due to loss of vegetation. Typically, runoff is also increased in post-fire locations due to potential of hydrophobic behavior of the soil. This condition varies due to soil type and intensity of the fire.

The report modeled the potential runoff volume based on a 2-year recurrence interval. This design storm will yield runoff values with a high probability of occurring in the immediate future. Most local storm runoff facilities are design using the 10-year storm event. This method will result in much higher peak flows for the same watershed, but have a lower probability of occurring in the immediate future. The 10-year event method is typically used for sizing storm detention basins and storm drain pipe systems. In our opinion, the use of the 2-year design storm is appropriate to calculate runoff flows that are likely to occur within the time it takes for the vegetation to return. The scope of the Assessment did not include storm runoff volume mitigation, therefore a larger storm event is not warranted. The drawback of using the 2-year storm event for this assessment is that a larger rain event is statistically possible within the next few years.

This report includes the calculation of erosion and sediment production for the designed 2-year storm event. The BAER Soil Resources Report was referenced as to the details of the production model, but was not provided to our office. This report calculates a total sediment volume for the Buckeye Road drainage watershed of 89 cubic yards. The Water Tank Drainage watershed had a calculated sediment volume of 203 cubic yards.

Geologic Hazard Assessment

This report provided by the NPS staff was reviewed prior to visiting the project site. The report identifies a number of values at risk (VARs) due to the El Portal Fire. It mentions that the USGS conducted a debris flow assessment of the fire area. Multiple storm events were referenced beyond the 2-year design storm used in the Hydrology Report.

Using a 10-year storm event, Figure 2 in the report shows severity classes for debris flow. The two structures under review are shown downstream of Moderate Debris Flow Hazard watersheds, with a 20-40% probability of 1,000 to 10,000 cubic yards of debris flows.

When attempting to design mitigation measures for debris flows in the specific drainage channels, this range of volume is substantial. Our office prepared rough volume calculations for each channel to see what volume a typical and realistic six foot high check structure could detain. For the Buckeye Road Drainage channel upstream of the structure, a 6 foot tall dam could retain approximately 286 cubic yards of material. A similar 6 foot structure within the Water Tank Drainage channel, it could retain 50 cubic yards. In order to properly design realistic mitigation measures, a more specific debris volume to the nearest 100 cubic yards would be required.

Topographic Exhibit

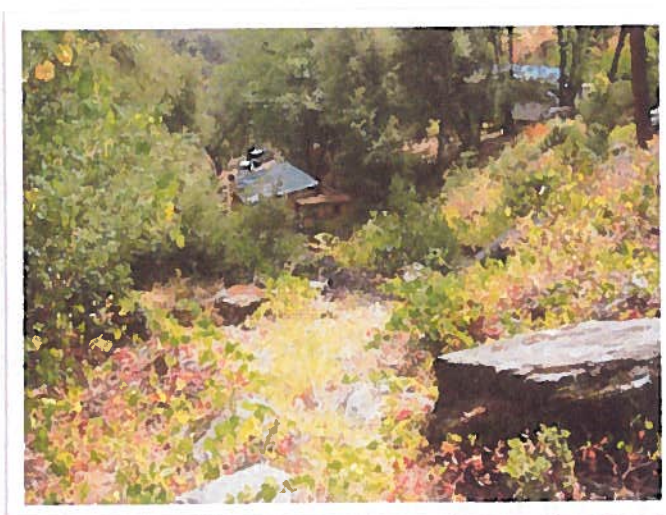
The exhibit provided by NPS staff depicted the El Portal Community buildings, roadways and ground elevation contours. The contours were verified to roughly match the USGS 7.5-minute quadrangle. After visiting the two sites, it was clear that the contours provided on the exhibit can only be used in rough planning and not relied upon for design. The contour interval is 40-feet, which does not reveal the detail of the drainage channels. The exhibit was used to get approximate channel slopes and create planning level profiles and cross-sections. A detailed topographic survey will be needed in order to design construction elements in specific locations.

Water Tank Drainage

The existing drainage channel that is located near both upper and lower water tanks has been referred to in the Hydrology Resource Report as the “Water Tank Drainage.”

Existing Conditions

As discussed previously, this drainage channel rises approximately 280-feet in elevation within the first 1000-feet above the structure. The terrain immediately upstream of the structure is rocky and overgrown with ground cover including poison oak. The channel does not noticeably flatten out as it rises upstream. The side slopes of the channel range from approximately 20° to 45°. The slopes of the channel appear to consist mainly of igneous rock with very little exposed sediment. Construction access to the channel will be limited to walking or by helicopter.



The existing gabion weir structure is located approximately 480-feet upstream of the house structure. Construction access to the weir is available from the access road serving the upper water tank and an unmaintained dirt road. Additional earthwork may be necessary to improve the dirt road to provide construction equipment access to the gabion structure and channel immediately upstream.

Mitigation Recommendations

Existing Gabion Weir

As recommended in the Geologic Hazard Assessment Report and Hydrology Resource Report, the existing sediment deposited on the upstream side of the weir could be removed to increase the volume capacity of the structure.

In order to provide additional volume as calculated in the Hydrology Resource Report, 200 cubic yards of volume could be achieved by removing native from the



upstream sides of the drainage channel. This mitigation would require removal of one to three large trees and some brush vegetation. A geotechnical assessment of the native soil would determine the maximum slope allowable for this mitigation.

Increasing the sediment detention volume by increasing the height of the existing weir would require design from a geotechnical engineer and structural engineer. The integrity of the existing structure would need to be assessed and determined to be capable to withstand increased loads.

Rockfall Fences

Rockfall barrier fences of variable geometry are typically made of an engineered system of structural posts, cables and double twist wire mesh layer. This mitigation would be effective against the threat of large debris flows and reduce the threat of damage to the downstream structure and owner. The construction method could utilize piles and cable supports that could be installed without the requirement of large construction equipment.

Any number of fences could be installed at intervals up the drainage channel to further reduce the risk of large debris flows. The California Department of Transportation (Caltrans) has used this mitigation method along transportation routes with direct threat of falling rocks. The rockfall system would need to be engineered for a specific range of energy.

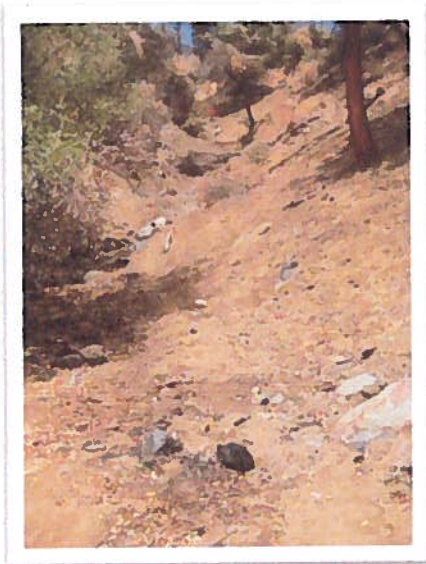


Erosion Control

Further upstream, it appears that native soil exposure has been increased due to the El Portal Fire. In an effort to reduce fine sediment from erosion into the drainage channel, straw waddles could be installed on the hillside. This mitigation measure is only effective for low flow runoff (1 cfs or less) and is not intended to reduce large debris flows. Installation on the higher hillsides contributing to the watershed could be an effective mitigation against fine sediment. For slopes in the 2:1 range, waddles should be installed approximately 20-feet apart along a consistent elevation contour, with a slight downward angle at the end of the waddle.

Buckeye Road Drainage

Existing Conditions



As discussed previously, this drainage channel rises approximately 440-feet in elevation within the first 1000-feet above the structure. The terrain immediately upstream of the structure includes rocks with diameters ranging from 3-inches to 2-feet, exposed soil and vegetation. The channel does not noticeably flatten out as it rises upstream. The side slopes of the channel range from approximately 20° to 45°. Construction access to the channel will be limited to small construction equipment around the house structure or along the dirt road upstream.

The dirt road crosses the drainage channel approximately 245-feet upstream from the house structure. Large construction materials could be lowered into the channel from the road with the use of cables if necessary.

Mitigation Recommendations

Gabion Weir

In order to reduce the volume of storm runoff from effecting the house, a gabion weir structure could be installed upstream and adjacent to the house. The channel widens to approximately 60-feet just upstream of the house. A weir could be designed to dissipate the runoff without completely retaining the water. For larger storm events, runoff would be detained until it is discharged through the gabion rocks. Drawbacks to this mitigation measure would be that the location limits the actual volume of runoff storage and becomes ineffective for mild storms. Sediment and debris would accumulate and maintenance would be needed to allow the weir to be effective. The proximity to the house structure would cause concern if the gabion structure were to fail.

Construction access on the dirt road upstream of the house structure could allow for the earthwork required to construct an additional gabion weir structure on the uphill side of the road. The footing for the gabion structure and sediment retention volume could be excavated from the road. The new structure could be 6 to 9-feet tall and would appear as a retaining wall from the road. Long-term maintenance would be possible utilizing the existing dirt road.

Storm Runoff Piping

Since the house structure is immediately in the flow of runoff, no matter the size of the storm, a storm pipe network could be installed to re-direct the runoff around the house. Corrugated Metal Pipe (CMP) could be used with very little required cover to collect runoff and discharge the water on either side of the house. With the use of a pipe manifold, the runoff would be split. If multiple discharge locations were used along the piping, the runoff would not cause point loading for downstream improvements.

Rockfall Fences

Rockfall barrier fences of variable geometry are typically made of an engineered system of structural posts, cables and double twist wire mesh layer. This mitigation would be effective against the threat of large debris flows and reduce the threat of damage to the downstream structure and owner. The construction method could utilize piles or cable supports that could be installed without the requirement of large construction equipment.

Any number of fences could be installed at intervals up the drainage channel to further reduce the risk of large debris flows. The California Department of Transportation (Caltrans) has used this mitigation method along transportation routes with direct threat of falling rocks. The rockfall system would need to be engineered for a specific range of energy.

Pre-cast Concrete Block Wall

An alternative to constructing gabion style weirs and check dams, would be to install a structure made of pre-cast, interlocking concrete blocks. Products are available in multiple sizes and configurations. One benefit to this mitigation is the reduced effort required for on-site installation. Pre-cast units would be transported to the site and installed with small or medium sized construction equipment.

Pre-cast concrete blocks required for this mitigation could have dimensions of 2'x2'x2' or 2'x2'x4'. They would be placed on a compacted soil or aggregate footing, placed longitudinally in the channel, and stacked to a height of 4 to 6-feet. This style mitigation would not be effective as a storm water retention, but rather for water runoff detention, sediment collection and debris protection.

This style of construction would be considered temporary for a few years. Once the vegetation upstream is re-established, the pre-cast concrete blocks could be removed and the channel could be returned to its previous cross section.

Erosion Control

Further upstream, it appears that native soil exposure has been increased due to the El Portal Fire. In an effort to reduce fine sediment from erosion into the drainage channel, straw waddles could be installed on the hillside. This mitigation measure is only effective for low flow runoff (1 cfs or less) and is not intended to reduce large debris flows. Installation on the higher hillsides

contributing to the watershed could be an effective mitigation against fine sediment. We calculate that approximately 700 linear feet of a straw waddle would be needed for each contour. For slopes in the 2:1 range, waddles should be installed approximately 20-feet apart along a consistent elevation contour, with a slight downward angle at the end of the waddle.

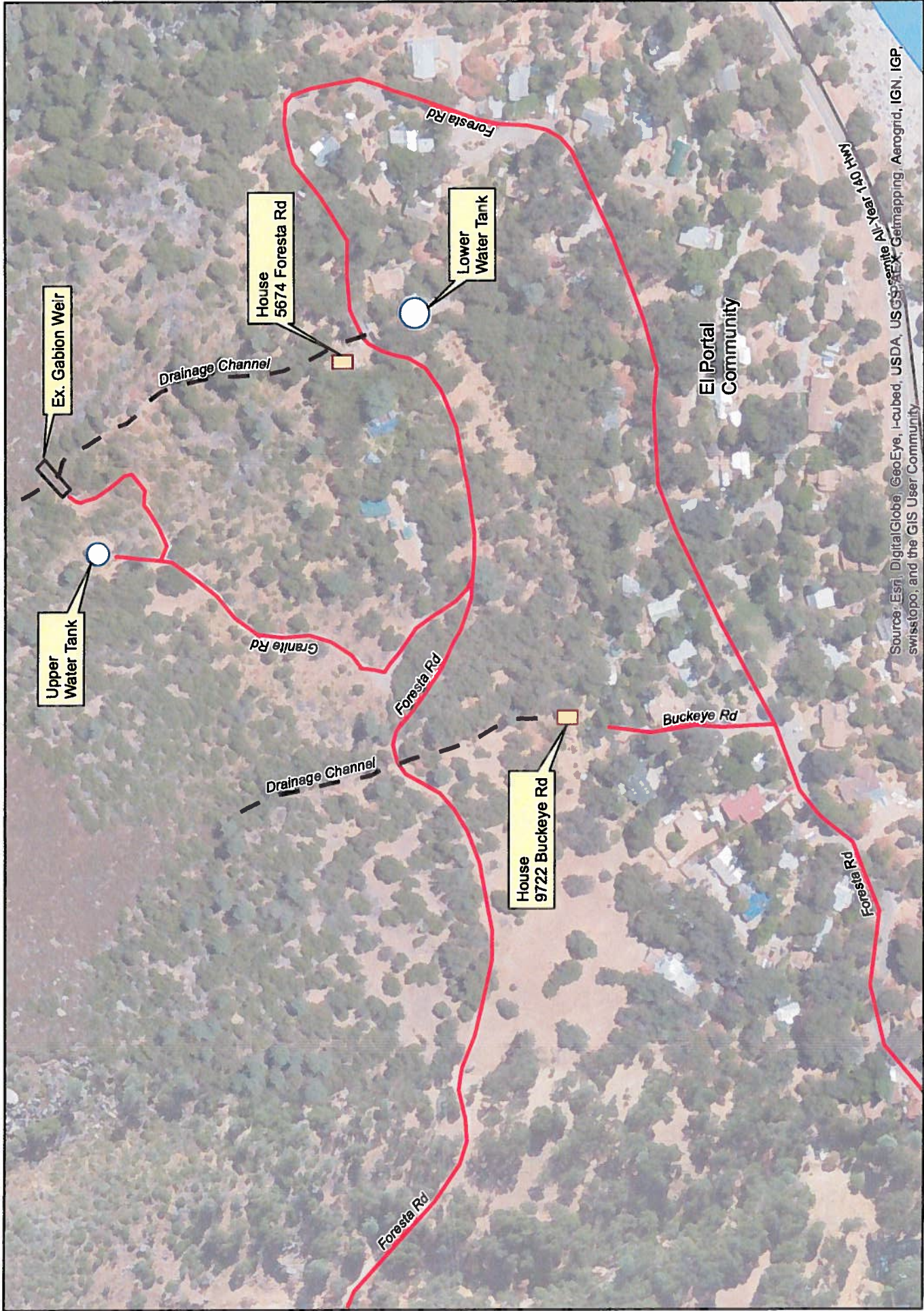
Opinion of Cost

Each recommended mitigation will range in construction cost due to the complexity of the mitigation and difficulty of construction. Regardless of the chosen mitigation design for each channel, incidental costs for construction will be incurred for mobilization, traffic control, site preparation, etc. The unit costs provided in our opinion of cost are subject to change due to construction market fluctuations and availability of supplies.

Item	Units	Unit Cost	Extension
Maintain Existing Gabion Rock Structure	1 ls	\$20,000	\$20,000
6ft High Gabion Rock Structure	150 cy	\$200/cy	\$30,000
6ft High Pre-cast Concrete Block Structure	20 blocks	\$500/block	\$10,000
6ft High Rockfall Fence Structure	240 sf	\$50/sf	\$12,000
Earthwork for Gabion or Concrete Block	100 cy	\$70/cy	\$7,000
Straw Waddle Erosion Control	700 lf	\$17/lf	\$11,900

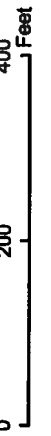
Exhibits

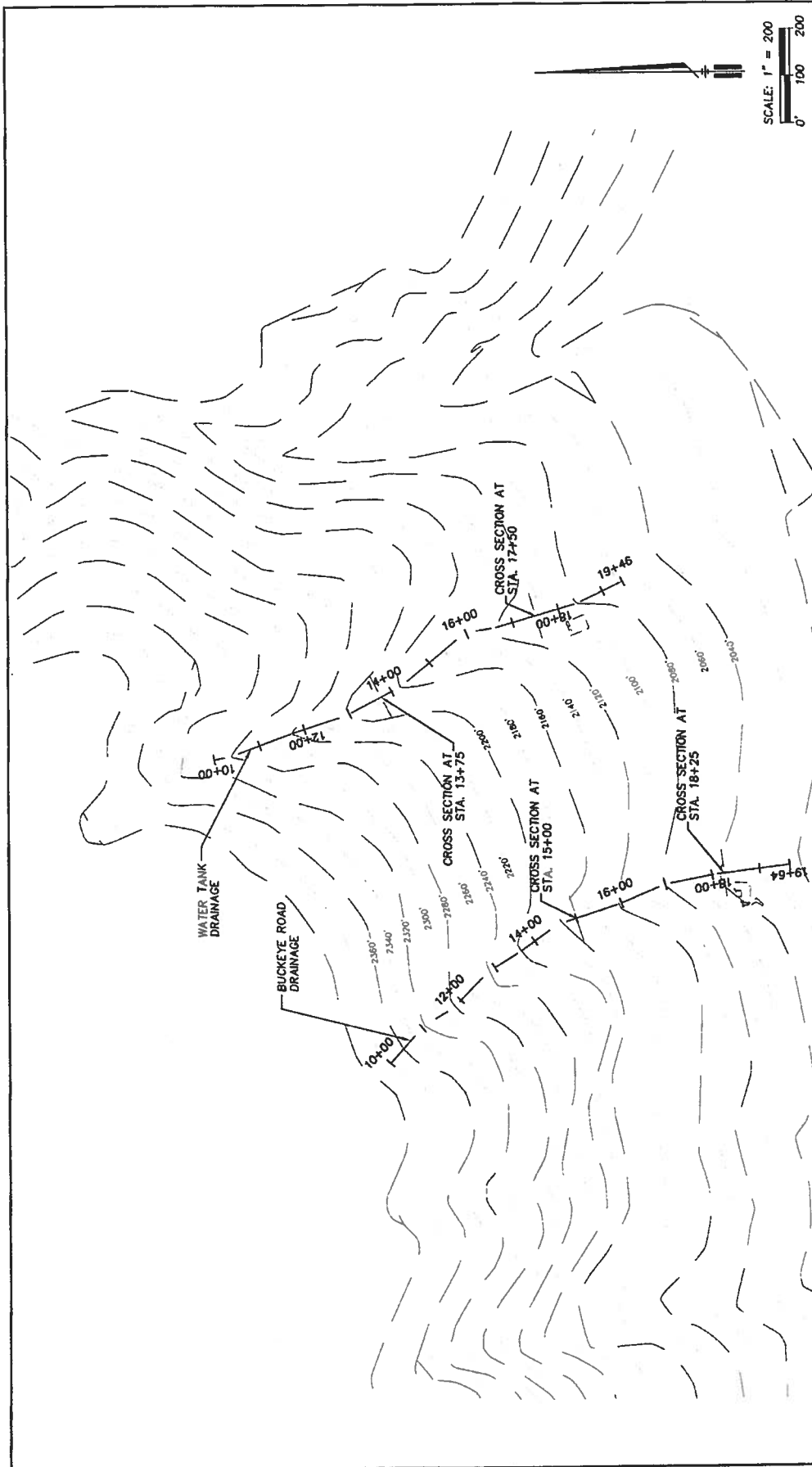
1. Site Map
2. Existing Contours
3. Existing Profiles and Cross-sections
4. Existing Gabion Weir
5. Volume Calculations
6. Rockfall Fences Concept
7. Gabion Weir Concept
8. Pre-cast Concrete Wall Concept
9. Storm Runoff Piping Concept



El Portal - Vicinity Map (14-259)

— Roads — Drainage Channels

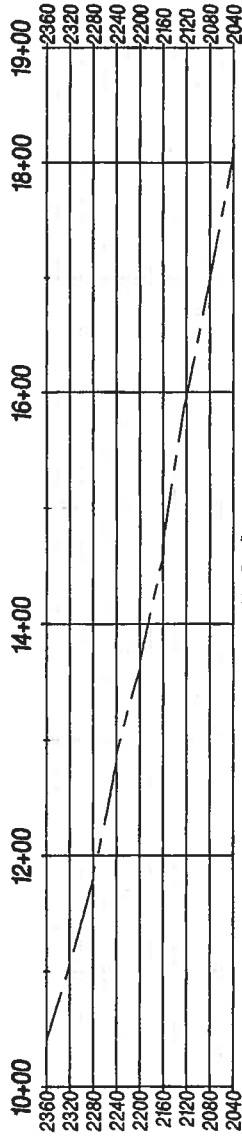




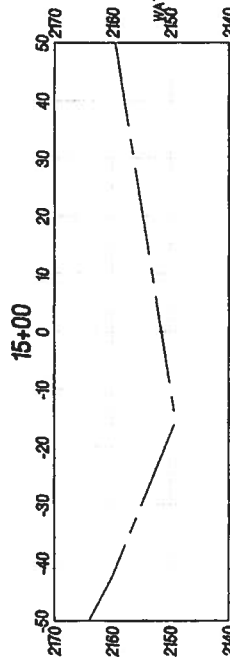
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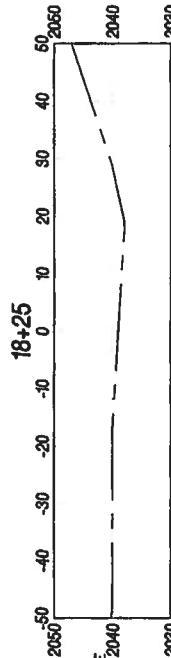
BUCKEYE ROAD DRAINAGE



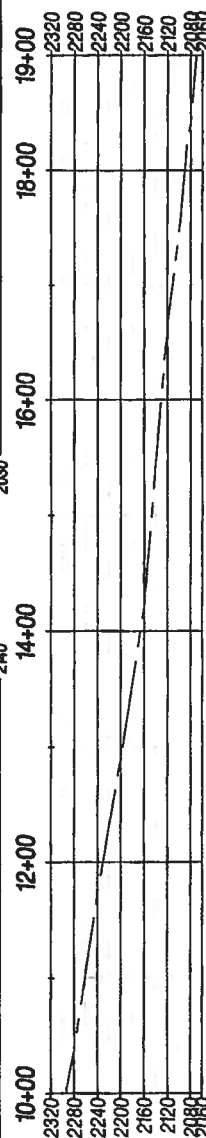
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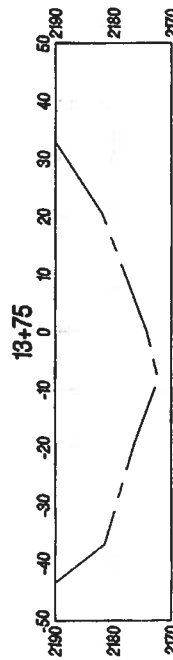
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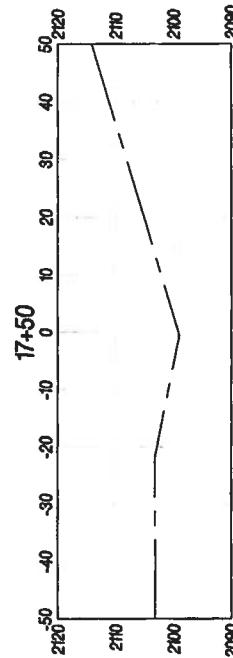
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SCALE: 1" = 20'



SCALE: 1" = 20'

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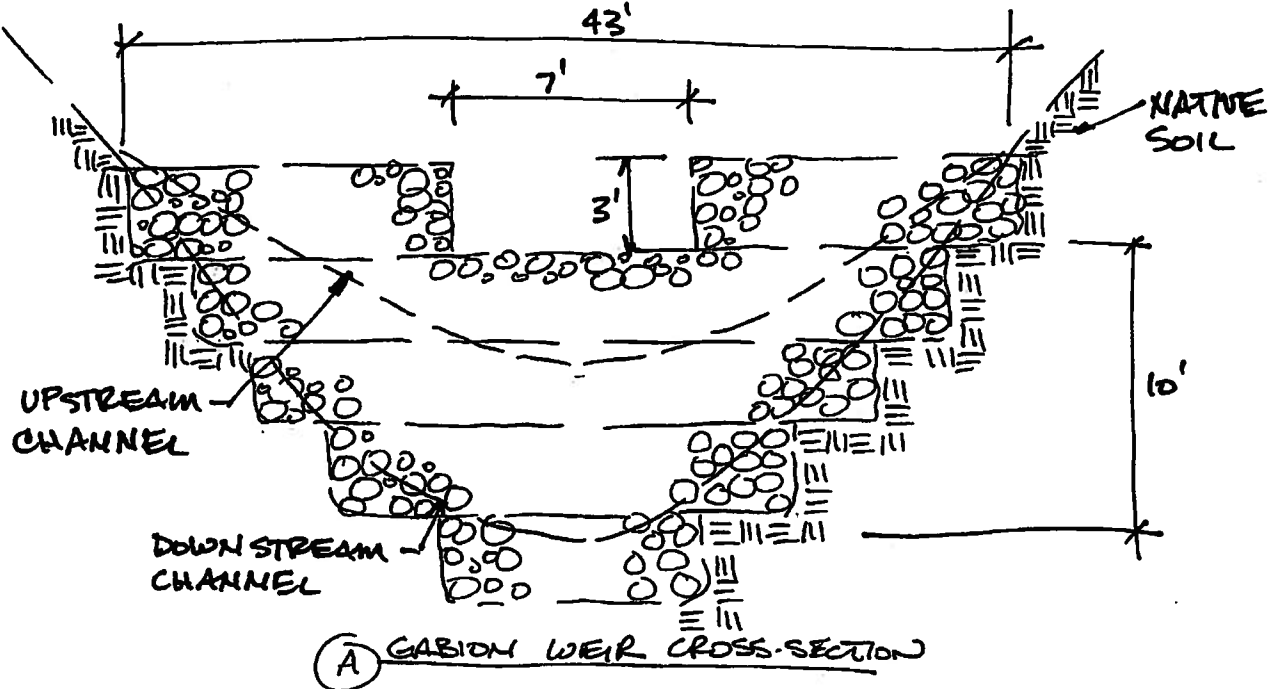
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Checked By

Scale NTS

EXHIBIT 4



CONCEPTUAL
LIMITS OF
NEW
EXCAVATION

EXISTING
CONTOURS

EXISTING
TREES

EXISTING
GABION
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EXHIBIT 5

Cut/Fill Report

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* Value adjusted by cut or fill factor other than 1.0

2 OF 2



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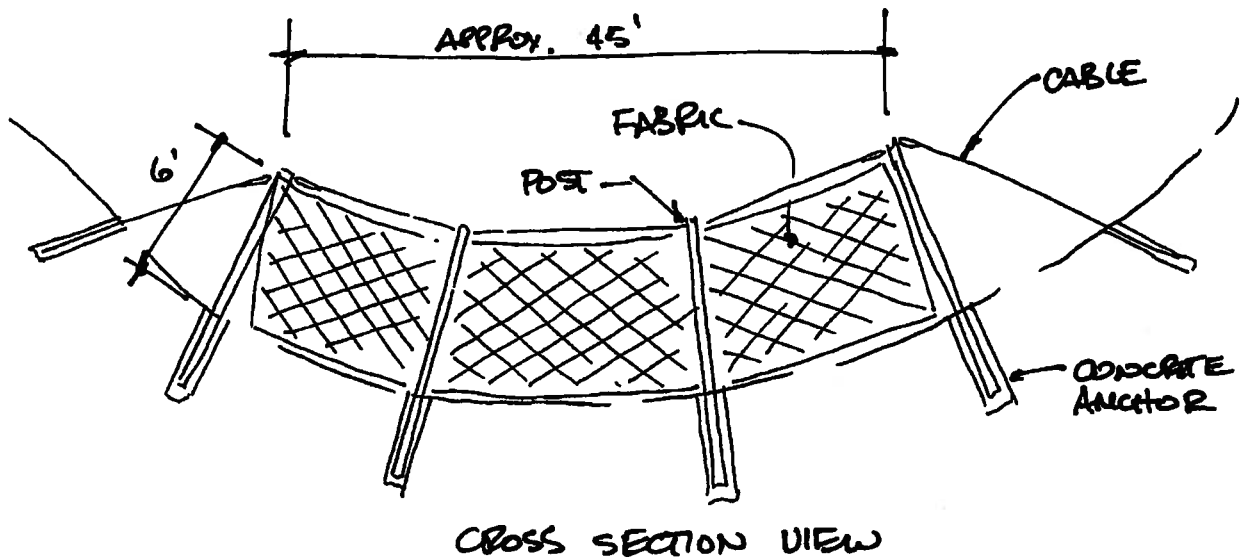
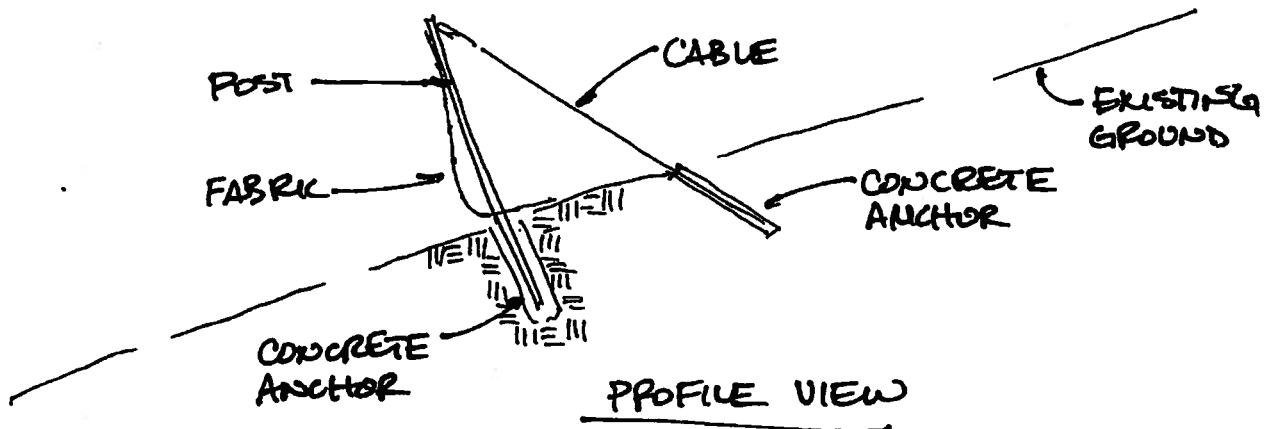
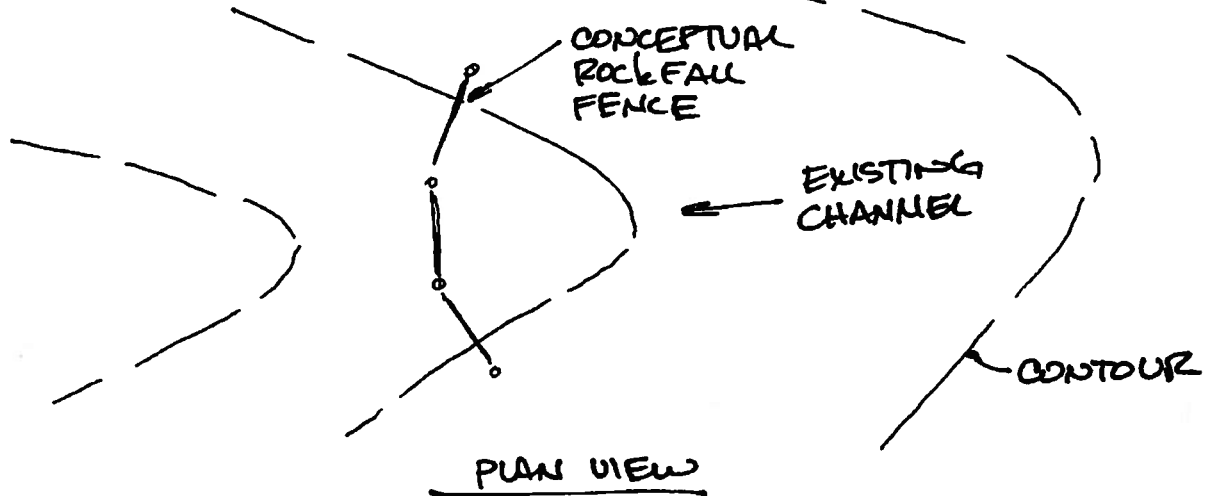
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EXHIBIT 6





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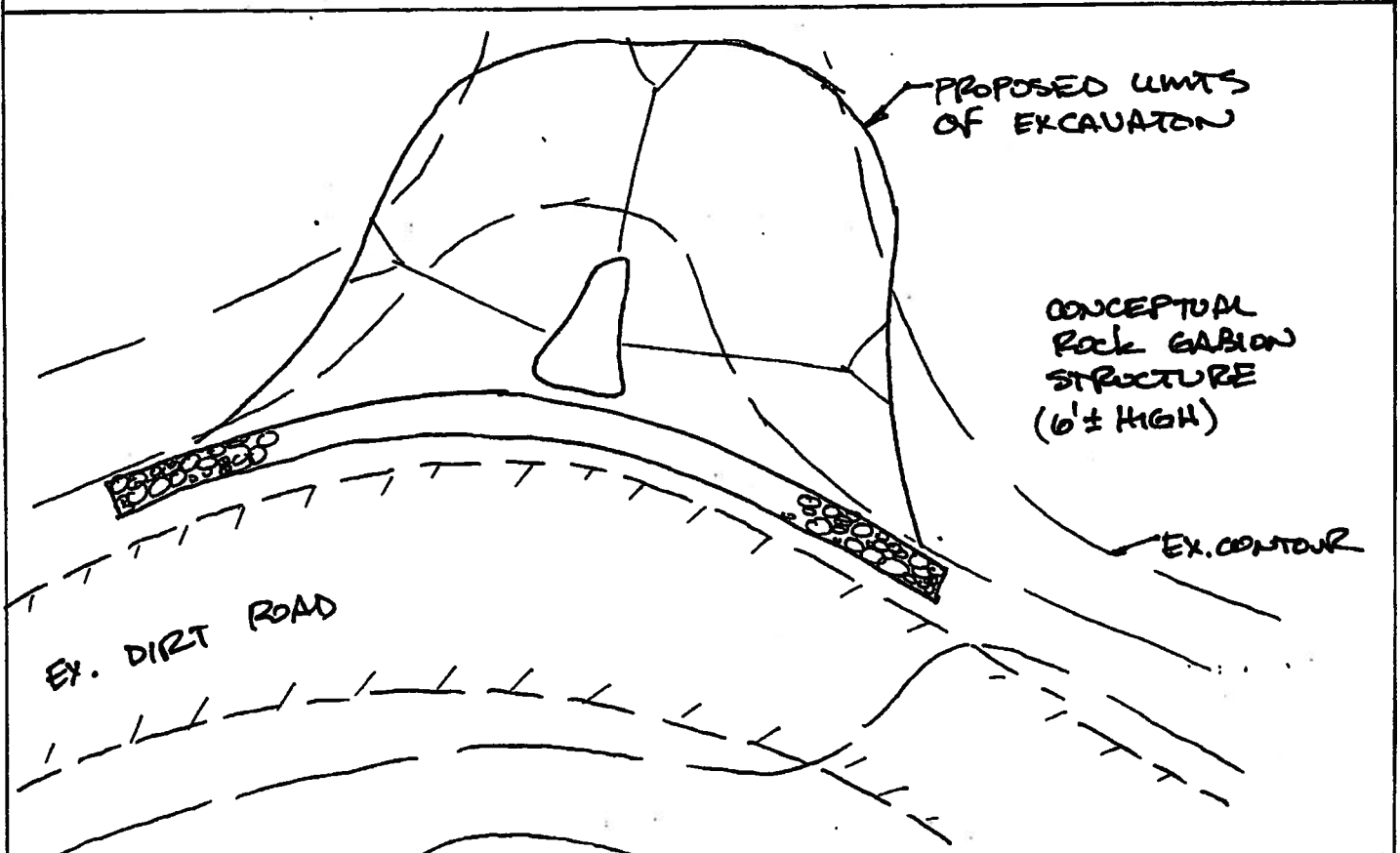
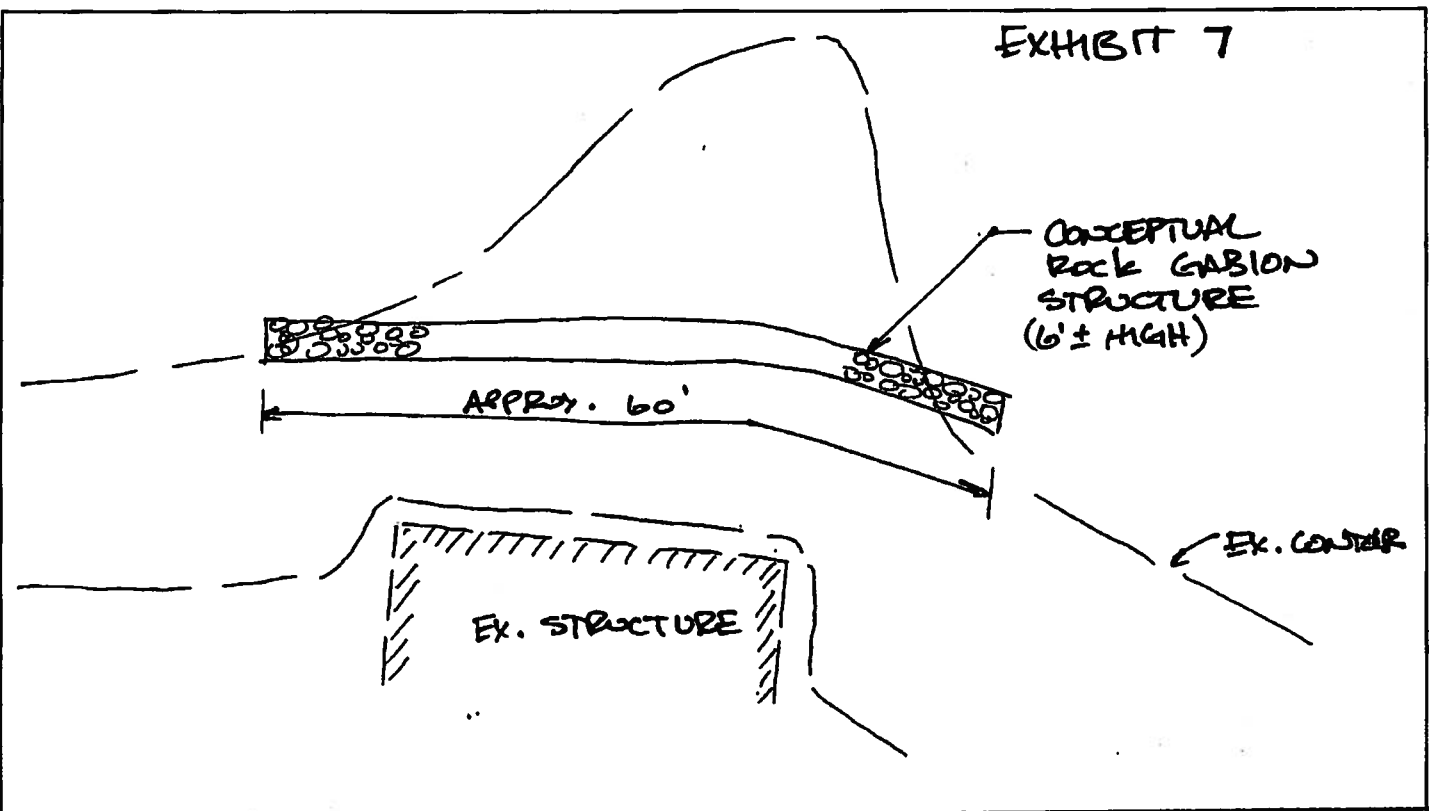
Project EL PORTAL FIRE

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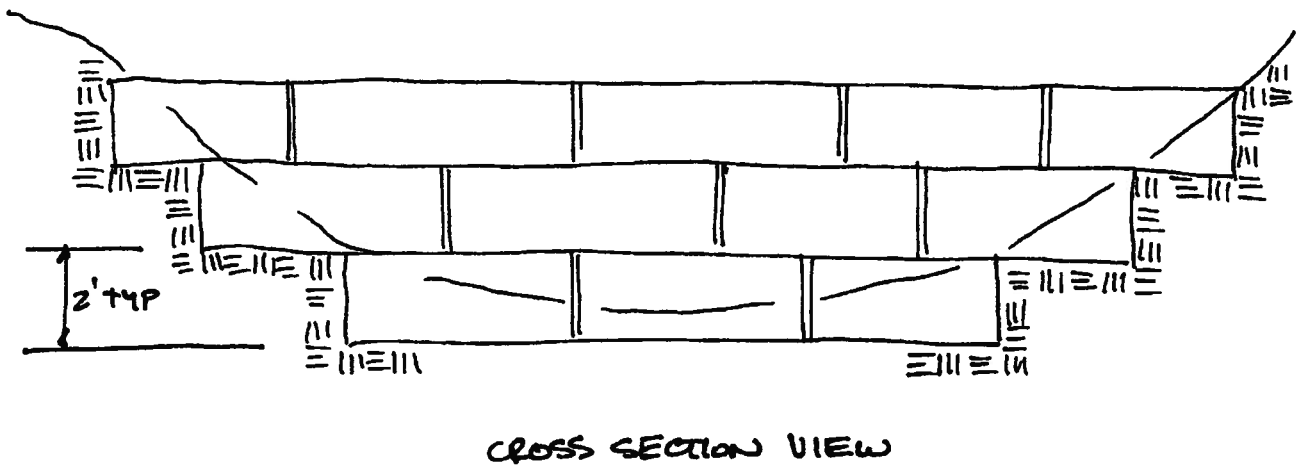
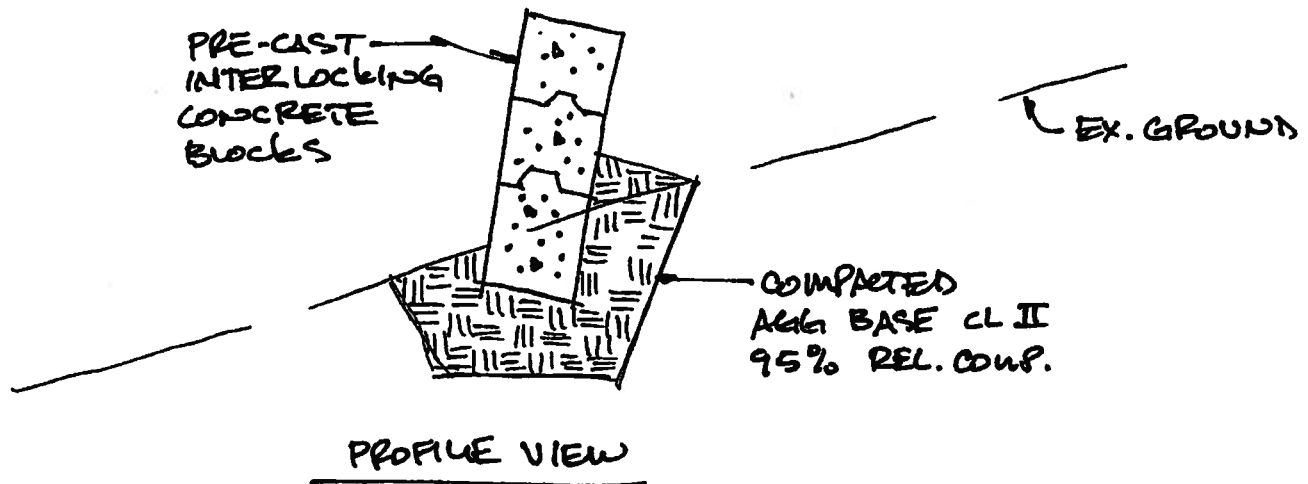
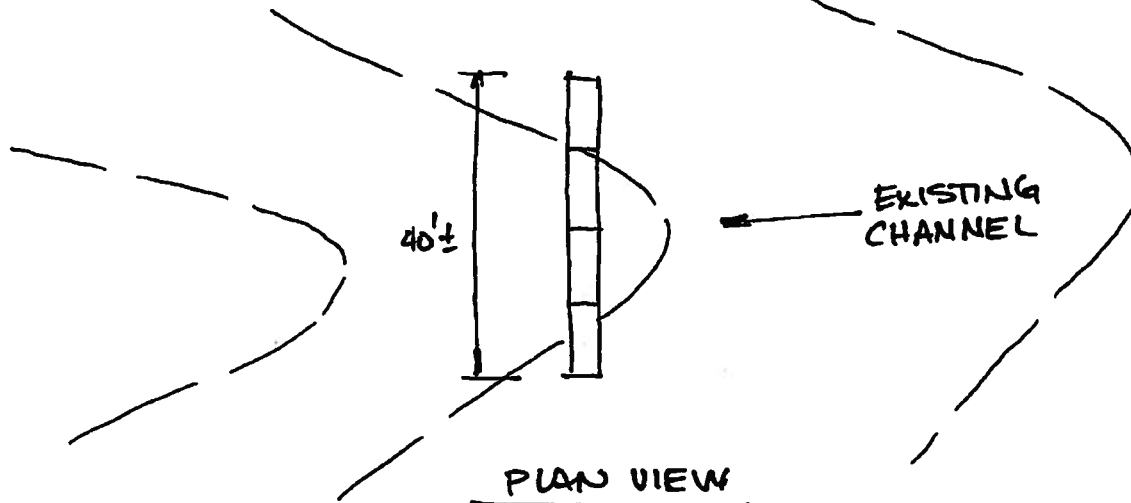
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EXHIBIT 8



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EXHIBIT 9

